

nausea, vomiting, abdominal cramping, and diarrhea. Sometimes there is headache; backache; chilliness and low-grade fever, occasionally reaching 105 degrees rectally; and rarely, a few days of mild acute jaundice. It has not been uncommon for those not fully acquainted with the disease to remove an appendix because of localization of the pain with rebound tenderness upon examination, and at operation the appendix is found, to be normal except for a marked scarlet hyperemia which is evenly distributed to the entire gastro-intestinal tract as well. Normal or diminished white blood counts are the rule, and if appreciably raised to high levels after adequate hydration some secondary factor is most usually present or the diagnosis is questionable.

Sometimes there are markedly hyperemic tonsils present, and occasionally bronchitis, or bradycardia. I have never seen a true constipation, though the bowels may not move for a day or two due to excessive and frequent vomiting which preclude the ingestion of food.

#### ETIOLOGY

Despite numerous investigations upon the parts of many qualified individuals, governmental agencies, and university laboratories, the inciting agent remains unknown, but the consensus is that a virus will ultimately be incriminated. The usual bacteria responsible for gastroenteritis have definitely been ruled out in the opinions of most competent investigators.

#### TREATMENT

Treatment in severer cases will have to be symptomatic and it is useless to give anything by mouth, as it induces prompt vomiting. These patients require rest in bed in a quiet room with dextrose solution by venoclysis. As the nausea subsides a few drops of sweetened liquid may be given at very frequent intervals, and increased to sips as tolerated. If vomiting recurs, the procedure will have to be gone through all over again. Physics are contraindicated and so are the sulfa drugs. Milk of Bismuth combined with chalk mixture, U. S. P. IX, has usually been helpful when patients reach a stage where they can sip and retain it. Heat is most comforting when applied to the abdomen.

#### COURSE

The disease is self-limited and usually over in three days, but occasionally lasts ten. It must be differentiated from the various other types of acute gastroenteritis and food poisoning, and more often than usually mentioned in the literature, from acute conditions of the abdomen, especially acute appendicitis.

Cases are being seen with increasing frequency in the dependents of all armed services, particularly in the members of dependent families recently removed to the west coast, and they are usually diagnosed under the present nomenclature as acute gastroenteritis, which does not tell the true story; but, since the disease is non-fatal, this is not too significant save from the standpoint of gathering accurate statistical and epidemiological data.

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## INTERCOSTAL NERVE BLOCK\*

ITS RÔLE IN THE MANAGEMENT OF THORACIC CASUALTIES

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THE use of nerve block in the treatment of thoracic trauma has not received the attention to which it is entitled. The previous literature is not extensive and has been covered by Harmon<sup>1</sup> and by De Bakey.<sup>2</sup> Price<sup>3</sup> has used nerve block in controlling pleural pain due to disease. Harmon and his co-workers reported excellent results following local injection at the sites of fractured ribs, although apparently they did not appreciate that the relief of thoracic wall pain was a significant factor in helping to improve bronchial drainage. Rovenstine and Byrd<sup>4</sup> employed intercostal regional block for the relief of pain. For reasons to be presented below we have usually preferred a type of regional block rather than local infiltration. Wide experience in treating thoracic wounds has been gained with colleagues of an Auxiliary Surgical Group in the Mediterranean theater of war during the past two years, and the value of regional, paravertebral, and local block of the intercostal nerves has been frequently demonstrated. Several hundred nerve blocks of various types have now been performed. This experience has been summarized in part by Fitzpatrick, Adams and Burbank.<sup>5</sup>

Regardless of the type of injury or method of injection, the control of pain remains the basic aim of treatment. Pain has an important bearing on the patient's immediate reaction to injury. Clinical shock may be initiated or may be prolonged by severe pain. Early transportation, so frequently necessary under combat conditions, is greatly facilitated if pain has been controlled; the patient travels more safely and in greater comfort. Second, but always dependent on relief from pain, nerve block helps to secure adequate bronchopulmonary drainage in patients who have excessive secretions and an obstructed air-way. Third, pain and discomfort following thoracic operations are effectively relieved by intercostal nerve injections. Finally, when thoraco-abdominal wounds are suspected, the response to nerve block in some instances may aid in distinguishing between abdominal pain due solely to thoracic trauma and abdominal pain which results from intraperitoneal pathology. Incapacitating pain may be associated with any type of thoracic injury: minor soft tissue contusions or hematomas in the thoracic wall; all varieties of fractured ribs; small penetrating wounds, and severe, lacerated or avulsed wounds. Nerve block may be used to control thoracic pain of any degree or extent. Indeed, the most spectacular results from block have been in patients whose area of pain was widespread.

Heretofore adhesive strapping has been the most frequent means of attempting to control thoracic pain, especially when it has been due to fractured ribs. Adhesive strapping is still required for stabilization in a few instances where multiple anterior and posterior rib fractures have produced a "flail" chest with paradoxical motion. Otherwise it has been almost completely discarded.

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God and the doctor we alike adore  
But only in danger, not before;  
The danger o'er, both are alike requited,  
God is forgotten, and the doctor slighted

—John Owen

Regardless of how applied strapping is frequently uncomfortable and essentially unphysiologic. Immobilization is never complete nor is the pain always relieved. There is continued compression of the thoracic cage which limits respiratory excursion and pulmonary expansion. This interferes with the efficiency of cough and favors the retention of excess bronchial secretions. As sequelae, atelectasis and pneumonitis occasionally have been observed.

War wounds are always contaminated wounds. Because of this and because many of the injuries are extensive, regional nerve block has been considered more efficient and safer than local infiltration at the injured site. Multiple intercostal injection has been employed most frequently and has been routinely performed at the angles of the ribs. Paravertebral block has been reserved for patients either in whom the intercostal injection was not completely effective, or in whom the wound itself was well mesial to the midscapular line. With paravertebral block both the intercostal nerves and the sympathetic chain are probably infiltrated at the same time. In rare cases of simple fractured ribs, local injection has been used to supplement the other two methods. In planning the injection, wounds and fractured ribs are noted and the area of skin tenderness is outlined. Intercostal or paravertebral infiltration is then performed to include at least two nerves above and two below the painful region. There is no hesitancy in injecting 10 or 11 nerves on one side or in performing bilateral blocks of from five to eight nerves each. In a successful block there is immediate relief from pain and the often dramatic change in the patient's condition will not be soon forgotten. A patient who has been restless, dyspneic and groaning with pain, shortly will be breathing normally and become relaxed and comfortable. Often he will fall asleep within a few minutes.

In nearly all instances the effects of nerve block have lasted for at least 24 hours and, frequently, only one injection has been necessary for permanent relief from pain. This has been a matter for some speculation since the *anesthesia* from injection lasts for only a few hours. Nerve block causes paralysis of the affected intercostal muscles, thereby relieving any associated muscular spasticity. This may be one factor involved in the prolonged effect of the block.

#### REPORT OF CASES

CASE 1.—A 24-year-old soldier received anterior and posterior fractures of the right 5th and 6th ribs in a truck accident in North Africa. The right midthorax was exquisitely tender, and there was paradoxical motion of an area in the axilla, roughly 10 by 5 cm. in extent. Intercostal block of the 3rd through the 8th nerves was performed. Pain and dyspnea were immediately relieved. As respirations became quiet the paradoxical motion completely disappeared and no adhesive stabilization became necessary.

CASE 2.—(Case of Major Frank). A 28-year-old sergeant on the Anzio beach-head suffered multiple contusions of the left chest and simple fractures of the 5th through the 11th ribs on that side. There was excruciating thoracic pain unrelieved by morphine; respirations were rapid, shallow, and grunting. Pain was increased by the short haul to a Field Hospital. Intercostal nerve block, D5 through D11, was performed nine hours after injury. There was immediate cessation of pain, and respirations became normal. No further blocks were necessary and the patient was evacuated by air to Naples in complete comfort.

CASE 3.—A 27-year-old officer sustained a penetrating shell fragment wound of the right posterior thorax in an advance in France. He was admitted to a Field Hospital eight hours after wounding. A ragged 3 cm. wound was present, with compound, comminuted fractures of the 6th and 7th ribs mesial to their angles. Thoracic wall pain was so intense that the patient could not lie on his back,

but was forced to remain prone. Morphine and adhesive strapping had not controlled the pain. With the patient still lying in the prone position, a paravertebral block from the 4th to the 9th nerves was performed. Cessation of pain was almost immediate, and the patient drew his first easy breath in more than eight hours. He could then be turned on his back and shortly thereafter was evacuated in comfort.

#### COMMENT

Many patients with thoracic injury suffer early respiratory distress and show signs of increased pulmonary moisture. Both fine and coarse rales may be heard over one or both chests. There develops a harassing, painful, wet cough and the patient continues to be unsuccessful in raising the blood and other secretions which flood the bronchial tree. Such is a brief description of what we have designated as the traumatic wet lung syndrome. Proper control of this condition is essential to preserve life and to prepare the patient either for early surgery, or for further evacuation. Tracheobronchial patency depends upon an efficient cough mechanism, and this is most frequently hindered by thoracic pain. Following nerve block, in most instances the patient is able to breathe deeply and to raise sputum effectively. Another possible effect of nerve block is suggested by the work of De Takats<sup>6</sup> who showed that in experimental animals bronchial and bronchiolar spasm followed injury to the thoracic wall. We have considered that the arrest of afferent painful stimuli by nerve injection may play a rôle in releasing the possible spasm. The other methods of treating wet lung are not germane to this paper and have been presented fully elsewhere.<sup>7,8</sup> Frequently, however, nerve block and continued voluntary cough are all the measures necessary to maintain adequate bronchopulmonary drainage.

CASE 4.—A 22-year-old private suffered severe contusions of the left chest when a truck overturned in North Africa. There was diffuse tenderness over the left lower chest, but no fractured ribs were demonstrated. The patient had a constant wet cough, and coarse rales were heard throughout the left lung. An intercostal block of the 6th to the 11th nerves was performed. Pain was relieved and the patient commenced to raise sputum with ease. Over a 4-hour period he expectorated 100 cc. of tenacious, bloody secretions and the rales disappeared. Only one nerve block was necessary.

CASE 5.—A 27-year-old sergeant received a penetrating gunshot wound of the right chest in Italy. He was admitted to a Field Hospital six hours later, where roentgenograms showed a small right-sided hemothorax, contusion of the lower lobe, and fractures of the 5th and 6th ribs posteriorly. The bullet was buried in the body of the 6th thoracic vertebra. The soldier had an unproductive, painful, wet cough, and was dyspneic. The 4th, 5th, 6th and 7th nerves were injected with only partial success. This was followed by paravertebral block of the same area, which resulted in complete cessation of pain. The cough immediately became productive of large amounts of bloody sputum, and the shortness of breath disappeared. Twenty-four hours later there was another episode of painful unproductive cough, and a second paravertebral nerve block gave complete relief. The patient was then evacuated without incident.

CASE 6.—(Case of Major Thomas Burford and Benjamin Burbank). A 25-year-old soldier was in a truck accident in Italy, which resulted in fractures of the left 9th, 10th, and 11th ribs, and a hematoma of the thoracic wall. On entrance to the hospital eight hours after injury, the patient had a painful, wet cough, was dyspneic, and presented numerous fine moist rales bilaterally. The lower six intercostal nerves were blocked on the left and there was immediate and complete disappearance of pain and rales. No further treatment was necessary. Results of this type offer the best proof for the existence of post traumatic bronchial spasm and its cessation following nerve block.

#### COMMENT

It is essential that pain be relieved following thoracic

operations. A smoother postoperative course is thus insured. The patient will be able to breathe deeply without discomfort, and to expectorate bronchial secretions more effectively. Following operations on the thoracic wall, the location of the incision will dictate whether a regional intercostal, or a paravertebral nerve block may be used to better advantage. When thoracotomy is performed an "internal" infiltration may be carried out, in which an adequate number of intercostal nerves are directly injected through the parietal pleura before the chest is closed.

Nerve block occasionally may help to distinguish between uncomplicated thoracic, and thoraco-abdominal wounds. Abdominal pain, tenderness, and rigidity frequently accompany a low but purely thoracic wound. These signs often disappear following injection of the lower thoracic nerves, and the abdomen becomes soft. When, however, abdominal signs are associated with intraperitoneal pathology, nerve block may be followed by cessation of pain and tenderness, but some involuntary rigidity usually remains.

#### TECHNIQUE

Intercostal nerve block is best performed with the patient in the lateral recumbent position and the scapula well forward. One per cent procaine solution is employed and five cc. are injected into each nerve. The addition of ten minims of 1-1000 epinephrine hydrochloride to each 100 cc. of procaine apparently prolongs the anesthetic effect. A small wheal is raised over the midpoint of the rib at its angle. The injection needle with bevel faced cephalad is inserted to the rib, then redirected until the point just clears the inferior margin of the same rib. It is then advanced 0.5 cm., and if aspiration is negative for blood, the procaine solution is injected.

Paravertebral injection may be performed with the patient either prone or in the lateral recumbent position. The sites of injection are approximately 4 cm. from the midline and exactly opposite the spinous processes. These points are directly over the transverse processes. A needle at least 8 cm. in length is needed, with a small piece of loose rubber over the shaft to aid in measuring the depth to which the needle is to be inserted. Each needle without the syringe is introduced perpendicularly through an intradermal wheal until the dorsal surface of the transverse process is touched (usually 4 cm.). The small rubber guide is adjusted on the shaft of the needle approximately 3 cm. from the skin surface. With the bevel faced toward the midline, the needle is then slightly withdrawn, redirected anteromedially and passed just below (or above) the transverse process, sliding along the body of the vertebra to the depth indicated by the marker. This places the point of the needle retropleurally in the region of the thoracic ganglia, and injection will usually anesthetize both the sympathetic chain and the intercostal nerve. Prior to infiltration, aspiration is done in two planes to rule out the possibility that the needle has entered the pleural cavity, an extension of the subarachnoid space or a blood vessel. Five cc. of one per cent procaine solution are then injected.

#### SUMMARY AND CONCLUSIONS

Obliteration of pain is an important step in the treatment of thoracic trauma. Recovery from shock is speeded, obstructing bronchopulmonary secretions are raised more efficiently, and the patient may be transported with greater safety and comfort. Absence of pain following thoracic operations will simplify postoperative care.

It has been emphasized that incapacitating pain may be associated with contusions of the thoracic wall, frac-

tured ribs, and wounds of various types. The rôle of intercostal and paravertebral nerve block in relieving thoracic wall pain of traumatic origin has been described and the techniques of injection have been presented. In treating battle injuries, the reasons for preferring a regional type of block instead of local infiltration have been given. Since nerve block has been employed, thoracic adhesive strapping for the control of pain has been discarded.

Brief case histories have been presented which illustrate the use of nerve block in different situations.

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## ACROPARESTHESIA

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THE present knowledge of this disease dates back about fifty years to the work of Schultze who in 1892<sup>1</sup> so well described it and gave it its name. Then with the work of Nothnagel we find presented before us two general types in which to divide these cases. The Schultze type in which there are no visible vasomotor symptoms, and the Nothnagel type in which these symptoms are present. Dr. R. Cassirer<sup>2</sup> in reviewing 162 cases estimates that about 25 per cent belong to this latter type.

After reviewing the recent literature and our own cases, it seems proper to consider this latter type an early Raynaud's in harmony with Spiegel<sup>3</sup> and eliminate them from this consideration. Further, this class is relatively rare, and also does not respond well to the same line of treatment as the Schultze type. This latter fact tends to uphold the belief that they belong with Raynaud's disease.

It is appropriate to refresh the mind briefly with the etiology, symptoms, and treatment of this disease before considering a rather typical case specifically.

#### ETIOLOGY AND SYMPTOMS

Acroparesthesia is the name applied to a sensory disturbance in the extremities, particularly the fingers consisting of sensations of burning, tingling, pricking, stiffness, and especially numbness or the feeling of the member of being asleep. Some writers report pain<sup>4</sup> and pallor but it is very rare in this class. Also the presence of radiculitis<sup>5</sup> is to be doubted. Putman<sup>6</sup> explained that these sensations are due to a decrease of blood flow in the extremities following a constriction of the arteriols which in turn is due to increase tonus of the Vegetative